
# SHIVAJI UNIVERSITY, KOLHAPUR

REVISED SYLLABUS AND STRUCTURE

SECOND YEAR (B. Tech.)

# Computer Sc.& Engineering (Data Science)

To be introduced from the academic year 2020-21

(i.e. from June 2021) onwards

**(Subject to the modifications will be made from time to time)**

| SECOND YEAR DATA SCINCE - CBCS PATTERN | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SEMESTER - III** | | | | | | | | | | | | | | | | | | | | | | |
| | | **TEACHING SCHEME** | | | | | | | | | **EXAMINATION SCHEME** | | | | | | | | | | | |
| | | **THEORY** | | | **TUTORIAL** | | | **PRACTICAL** | | | **THEORY** | | | | | **PRACTICAL** | | | **TERMWORK** | | |
| **Sr. N0.** | **Course Subject / Title** | Credits | N0. Of Lectures | Hours | Credits | No.of Hours | Hours | Credits | No . of Hours | Hours | Hours | mode | marks | Total Marks | MIN. | Hours | MAX | MIN. | Hours | MAX | MIN. |
| 1 | BSC - DS301 Applied Mathematics | 3 | 3 | 3 | 1 | 1 | 1 | | | | | CIE | 30 | 100 | 40 | AS PER BOS GUIDELINES | | | AS PER BOS GUIDELINES | 25 | 10 |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 2 | PCC- DS302 Discrete Mathematics & Structures | 3 | 3 | 3 | 1 | 1 | 1 | | | | | CIE | 30 | 100 | 40 | | | | | 25 | 10 |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 3 | PCC- DS303 Data Structures | 3 | 3 | 3 | | | | | | | | CIE | 30 | 100 | 40 | | | | | | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 4 | PCC- DS304 Computer Networks | 3 | 3 | 3 | | | | 1 | 2 | 2 | | CIE | 30 | 100 | 40 | | 50 | 20 | | 25 | 10 |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 5 | PCC- DS305 Microprocessors and Microcontrollers | 3 | 3 | 3 | | | | 1 | 2 | 2 | | CIE | 30 | 100 | 40 | | | | | 25 | 10 |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 6 | PCC- DS306 C programming | 3 | 3 | 3 | | | | 2 | 4 | 4 | | | | | | | 50 | 20 | | 50 | 20 |
| 7 | HM- DS307 Soft Skills | | | | | | | 1 | 2 | 2 | | | | | | | 25 | 10 | | 25 | 10 |
| | ***Total*** | ***18*** | ***18*** | ***18*** | ***2*** | ***2*** | ***2*** | ***5*** | ***10*** | ***10*** | | | | ***500*** | | | ***125*** | | | ***175*** | |

| SECOND YEAR DATA SCINCE - CBCS PATTERN | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEMESTER - IV | | | | | | | | | | | | | | | | | | | | | | |
| | | TEACHING SCHEME | | | | | | | | | EXAMINATION SCHEME | | | | | | | | | | | |
| Sr. N0. | Course Subject / Title | THEORY | | | TUTORIAL | | | PRACTICAL | | | THEORY | | | | | PRACTICAL | | | TERMWORK | | |
| | | Credits | N0. Of Lectures | Hours | Credits | No.of Hours | Hours | Credits | No . of Hours | Hours | Hours | mode | marks | Total Marks | MIN. | Hours | MAX | MIN. | Hours | MAX | MIN. |
| 1 | PCC-DS401 Automata Theory | 3 | 3 | 3 | | | | | | | | CIE | 30 | 100 | 40 | AS PER BOS GUIDELINES | | | AS PER BOS GUIDELINES | | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 2 | PCC- DS402 Computer Networks Protocols | 3 | 3 | 3 | | | | 1 | 2 | 2 | | CIE | 30 | 100 | 40 | | 50 | 20 | | 25 | 10 |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 3 | PCC- DS403 Statistic for Data Science | 3 | 3 | 3 | | | | | | | | CIE | 30 | 100 | 40 | | | | | | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 4 | PCC- DS404 Operating Systems | 3 | 3 | 3 | | | | 1 | 2 | 2 | | CIE | 30 | 100 | 40 | | | | | 25 | 10 |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 5 | PCC- DS405 Software Engineering | 3 | 3 | 3 | | | | | | | | CIE | 30 | 100 | 40 | | | | | | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| 6 | PCC- DS406 Python for Data Science | 2 | 2 | 2 | | | | 2 | 4 | 4 | | | | | | | 50 | 20 | | 50 | 20 |
| 7 | PW- DS407 Mini Project | | | | | | | 1 | 2 | 2 | | | | | | | 50 | 20 | | 50 | 20 |
| 8 | MC-DS408 Environmental Studies | 3 | 3 | 3 | | | | | | | | CIE | 30 | 100 | 40 | | | | | | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | | |
| | Total (SEM –IV) | 20 | 20 | 20 | | | | 5 | 10 | 10 | | | | 600 | | | 150 | | | 150 | |
| | ***Total*** | ***38*** | ***38*** | ***38*** | ***2*** | ***2*** | ***2*** | ***10*** | ***20*** | ***20*** | | | | ***1100*** | | | ***275*** | | | ***325*** | |

CIE- Continuous Internal Evaluation
ESE – End Semester Examination

| | |
|---|---|
| • Candidate contact hours per week : 30 Hours (Minimum) | • Total Marks for S.E. Sem III & IV : **600 + 500 = 1100** |
| • Theory and Practical Lectures : 60 Minutes Each | • Total Credits for S.E. Sem III & IV : **50 (SEM-III: 25 + SEM – IV: 25)** |
| • In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE. | |
| • There shall be separate passing for theory and practical (term work) courses. | |

Note :

1. BSC-CS: Basic Science Course – Computer Science and Engineering are compulsory.
2. ESC-CS: Engineering Science Course - Computer Science and Engineering are compulsory.
3. PCC-CS: Professional Core Course – Computer Science and Engineering are compulsory.
4. HM-CS: Humanities and Management- Computer Science and Engineering are compulsory.
5. PW-CS: Project Work-– Computer Science and Engineering are compulsory.
6. MC-CS: Mandatory Course -Environmental Studies which is compulsory for theory 70 marks and project work 30 marks.

# S. Y. B.Tech. (Data Science) Sem – III

## BSC-DS301–Applied Mathematics

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** 3 Hrs/Week | **Term work:** 25 marks |
| | **Tutorial :** 1 Hrs/Week | **Theory :** 100 marks |
| | **Practical: --** | **Practical : --** |

**Prerequisite:** Basic mathematics, Statistics

**Course Objectives:**

1. To develop mathematical approach for analyzing problems.
2. To understand numerical methods probability and statistics with an emphasis on the application of solving engineering problems
3. To prepare students to formulate a mathematical model using engineering skills & interpret the solutions.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to:

1. Describe the statistical data numerically by using Lines of regression and Curve fitting
2. Solve basic problems in probability theory, including problems involving the binomial, Poisson, and normal distributions.
3. Analyze problems using mathematics
4. Define fuzzy sets using linguistic words and represent these sets by membership functions, convexity, Normality, support, etc.
5. Solve examples on the principle in performing fuzzy number arithmetic operations such as Addition, Multiplication & fuzzy equation.
6. Solve assignment problems by using different techniques of operation research.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1. | **Correlation, Regression & Curve Fitting:** Introduction, Karl Pearson's Coefficient of Correlation, Lines of regression of bivariate data, Fitting of Curves by method of Least-squares, Fitting of Straight lines, Fitting of exponential curves,Fitting of second degree Parabolic curves. | 06 |
| 2. | **Probability Distribution:** Random variables, Discrete Probability distribution, Continuous probability distribution, Binomial Distribution, Poisson Distribution, Normal Distribution. | 07 |
| 3. | **Numerical Integration:** Newton Cotes formulae, Trapezoidal Rule, Simpson's 1/3rd rule, Simpson's $3/8^{th}$ rule, Weddle's Rule. | 06 |
| 4. | **Introduction to Fuzzy sets:** Crisp set and Fuzzy set, Basic concepts of fuzzy sets, Basic operations on fuzzy sets, Properties of fuzzy sets | 06 |

| | | |
|---|---|---|
| 5. | **Fuzzy Arithmetic:** Fuzzy numbers, Fuzzy cardinality, Arithmetic Operations on Fuzzy numbers, Solutions of Fuzzy equations of type A + X = B & A.X | 06 |
| 6. | **Assignment Problem:** Definition, Balanced and Unbalanced assignment problem, Hungarian Method, Balanced assignment problems, Unbalanced assignment problems, Traveling salesmen problem. | 08 |

**TEXT BOOKS:**


1. Advance Engineering Mathematics by Erwin Kreyszig (Wiley India).
2. Mathematical Methods of Science and Engineering, by Kanti B. Datta (Cengage Learning)


**REFERENCE BOOKS:**


3. Advanced Engineering Mathematics, 3e, by Jack Goldberg (Oxford University Press).
4. Engineering Mathematics by V. Sundaram (Vikas Publication).
5. Higher Engineering Mathematics, by B. S. Grewal (Khanna Publication Delhi).
6. Higher Engineering Mathematics, by B. V. Ramana (Tata McGraw-Hill).
7. Advanced Engineering Mathematics, by H. K. Das (S. Chand Publication).
8. Fuzzy Sets and Fuzzy Logic: Theory and Applications, by George J. Klir and Bo Yuan (Prentice Hall of India Private Limited).
9. Applied Mathematics by Navneet D. Sangle (Cengage Publication)


**General Instructions:**

1. For the term work of 25 marks, batch wise tutorials are to be conducted. The number of students per batch per tutorial should be as per University rules.
2. Number of assignments should be at least six (All units should be covered).

# PCC-DS302–Discrete Mathematics & Structures

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** 3 Hrs/Week | **Term work:** 25 marks |
| | **Tutorial :** 1 Hrs/Week | **Theory :** 100 marks |
| | **Practical:** 4 credit | **Practical :** .. |

**Prerequisite:** Basic Mathematics

**Course Objectives:**

1. Student should understand the mathematical logic related to computer science areas.
2. To enhance the problem solving skills in the areas of theoretical computer science.
3. To use mathematical concepts in the development of computer applications.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Apply logic concepts in designing a program.
2. Illustrate basic set concepts & apply operations on set.
3. Minimize the Boolean Function.
4. Apply basic concepts of probability to solve real world problem.
5. Represent data structures using graph concepts.
6. Design abstract machine, detect deadlocks.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Mathematical Logic:** Statements & Notations, Connectives, Statement Formulas & truth table, Well formed formulas, Tautologies , Equivalence of formulas, Duality law, Tautological Implications, Functionally complete set of connectives, Other connectives, Normal Forms, Theory of Inference for statement calculus. | 10 |
| 2 | **Set Theory:** Basic concepts of set theory, Operations on Sets, Ordered pairs & n-tuples, Cartesian product | 04 |
| 3 | **Relations & Functions:** Relations., Properties of binary relations., Matrix & Graph Representation of Relation., Partition & covering of Set., Equivalence Relations. , Composition of Binary Relation., POSET & Hasse Diagram., Functions, Types of Functions, Composition of functions.. | 06 |
| 4 | **Algebraic Systems:** Algebraic Systems: Examples & general properties., Semi groups & Monoids, Groups: Definitions & Examples, Subgroup & Homomorphism. | 06 |
| 5 | **Lattice and Boolean Algebra:** Lattice as partially ordered sets., Lattice as Algebraic Systems., Special Lattices., Boolean Algebra: Definitions & examples, Boolean Functions., Representation & Minimization of Boolean Functions. | 08 |
| 6 | **Graph Theory:** | 05 |

| | | |
|---|---|---|
| | Basic concepts of graph theory., Paths, Reachability & Connectedness, Matrix Representations of Graphs., Storage Representation & Manipulations of Graphs. PERT & Related technologies. | |

**Tutorials :**

1. It should consist of minimum 10 to 12 assignments based on topics of syllabus & Exercise problems mentioned in text books.
2. 4 to 5 implementations of above assignments using 'C' programming language.

**Text Books:**

1. "Discrete Mathematical Structures with Application to Computer Science" by J. P. Tremblay & R. Manohar (MGH International)

**Reference Books:**

1. Discrete Mathematics - Semyour Lipschutz, MarcLipson (MGH), Schaum's outlines.
2. Discrete Mathematics and its Applications - Kenneth H. Rosen (AT&T Bell Labs) (mhhe.com/rosen)
3. Discrete Mathematical Structures – Bernard Kolman, Robert Busby, S.C.Ross and Nadeemur-Rehman (Pearson Education)

# PCC-CS303 –Data Structures

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory:** 3 Hrs./ Week. | **Term work: --** |
| | **Tutorial: --** | **Theory:** 100 marks |
| | **Practical: --** | **Practical : --** |

**Prerequisite:** Logical Thinking

**Course Objectives:**

1. To make the students familiar with basic data structures.
2. To provide students with foundation in computer programming/ problem.
3. To teach the students to select appropriate data structures in computer applications.
4. To provide the students with the details of implementation of various data structures.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Identify the appropriate data structure for specific application.
2. Design and analyze programming problem statements.
3. Chose appropriate sorting and searching algorithms.
4. Outline the solution to the given software problem with appropriate data structure.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Basic of Data Structures**<br>Data structure- Definition, Types of data structures, Data Structure Operations, Algorithms: Complexity, Time and Space complexity. | 03 |
| 2 | **Searching and Sorting Techniques**<br>Linear search, Binary search, Hashing – Definition, hash functions, Collision, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Radix sort, Complexity and analysis. | 07 |
| 3 | **Stacks and Queues**<br>Stack: Definition, operations, Array representation of stack, applications Queue: Definition, operations, Array representation of queue, applications, Circular queue, Priority queue, Deque. | 07 |
| 4 | **Linked Lists**<br>Definition, representation, operations, implementation and applications of singly, doubly and circular linked lists. Linked representation of stack and Queue. | 06 |
| 5 | **Trees**<br>Terminology, representation, binary tree, traversal methods, binary search tree, AVL search tree, B tree, B+ tree, Heaps- Operations and their applications, Heap sort. | 07 |
| 6 | **Graphs:**<br>Basic concept of graph theory, storage representation, graph traversal techniques- BFS and DFS, Graph representation using sparse matrix. | 06 |

**TEXT BOOKS :**

1. Schaum's Outlines Data Structures – Seymour Lipschutz (MGH)
2. Data Structures- A Pseudocode Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2nd Edition

**REFERENCE BOOKS:**

1. Data Structure using C- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI)
2. Data Structures and Algorithm Analysis in C, 2 Edition, by Weiss, Pearson Education India.

# PCC-CS304 –Computer Networks

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory : 3 Hrs. / Week** | **Term work: 25** |
| | **Tutorial: --** | **Theory : 100** |
| | **Practical: 2 Hrs./Week.** | **Practical : 50** |

**Prerequisite:** --Basic Computer knowledge

**Course Objectives:**

1. To perceive fundamental concepts of Computer Networks
2. To understand layered architecture and basic networking protocols
3. To illustrate the TCP/IP protocol internal details

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Student will understand the fundamental concepts of Computer Networks.
2. Student will able to differentiate OSI and TCP/IP layered architecture
3. Student will apply practical knowledge of network and will able to form network,
4. Student will apply the principals of socket programming in the networks.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Introduction to Computer Network:** Overview of OSI layer Model and TCP/IP protocol model, Addressing, Underlying technologies for LANs, WANs, and Switched WANs. | 05 |
| 2 | **Data Link Layer** Design issues for Data Link Layers, Framing methods, Error control: detection and correction, Flow control, Elementary Data Link protocols, Sliding window Protocols, Go back n, Selective repeat. | 07 |
| 3 | **Medium Access Control Sub layer:** Static and Dynamic channel allocation, Multiple Access protocols ALHOA, CSMA, Collision Free Protocols, Ethernet: IEEE 802.3, IEEE 802.4, IEEE 802.5 standards, Wireless LANS 802.11 standards | 06 |
| 4 | **Network Layer:** IPv4 Addresses: Classful Addressing Other Issues, Sub-netting and Super netting, Class less Addressing, Delivery, Forwarding and routing; Routing methods: Shortest path, Link state, Distance vector routing and broadcast routing, Congestion control algorithms: Principles, Congestion prevention policies, congestion control in datagram subnet, Load Shedding, Jitter Control. | 06 |
| 5 | **Internet Protocol:** IP Datagram format, Fragmentation and reassembly models, ARP, RARP, ICMP, IGMP | 08 |
| 6 | **Transport Layer:** The Transport service primitives, UDP: Process to Process communication, User Datagram Format, Operation and uses of UDP. | 08 |

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|---|---|---|
| | TCP: TCP Services and Features, TCP segment format, TCP Connections, Flow and error<br>control in TCP, TCP Timers; Berkeley Sockets: Socket Addresses, Elementary Socket system calls byte ordering and address conversion routines, connectionless iterative server, connection oriented concurrent server, TCP and UDP Client server Programs. | |

**TERM WORK**

1. Study and demo of LAN, WAN and various connecting devices and components
List out component and devices required for a std. LAN, WAN
2. Study, design and configuration of IEEE 802.3 Ethernet and IEEE 802.11 Wireless LANs (Referring RFCs)
3. Study of following connectivity test tools with all its options –
    - ifconfig, arp, route, traceroute
      nmap, netstat, finger
4. Implementing Framing methods
5. Implementing Elementary data link protocol (Stop & wait protocol)
6. Implementation of Error detection (CRC) code
7. Implementation of Error detection codes (Hamming)
8. Programs to understand IP addressing, classful & classless addressing
9. Implementation of sliding window protocol.
10. Implement shortest path routing algorithm.
11. Programs for connection oriented (TCP) client-server using socket programming
12. Programs for connection less (UDP) client-server using socket programming
13. Study of network protocol analyzer (Ethereal or Wire-Shark) and understanding packet formats for UDP, TCP, ARP, ICMP protocols.

**INTRUCTIONS FOR PRACTICAL EXAMINATIONS:**

Term Work: It should consist of 10-12 experiments based on the syllabus and should be implemented by using Socket Programming. The study experiments should consist of some practical work and observations.

**TEXT BOOKS:**


1. TCP/IP protocol suit 4th Ed. – Behrouz A. Forouzen (Tata Mag. Hill)
2. Computer Networks – Andrew S. Tanenbaum (PHI)
3. Unix Network Programming – W. Richard Stevens (PHI)


**REFERENCE BOOKS*:***


1. TCP/IP Illustrated, The Protocols, Vol. I – W. Richard Stevens, G. Gabrani (Pearson Education.)
2. Internetworking with TCP/IP, Vol. I Principles, Protocols, and Architectures – D. E. Comer (Pearson Ed.)
3. Internetworking with TCP/IP, Vol. III, Client-Server Programming and Application (2nd Ed.) – D. E. Comer, David L. Stevens (Pearson Ed.)

# PCC-DS305 –Microprocessors & Microcontrollers

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory:** 03 Hrs / Week | **Term work:** 25 marks |
| | **Tutorial:** -- | **Theory:** 100 marks |
| | **Practical:**02 Hrs / Week | **Practical : --** |

**Prerequisite:** Fundamental of Electronics and Basic Computer

**Course Objectives:**

1. To learn the Architecture of Microprocessor and Microcontrollers
2. To learn different microcontroller development platforms
3. To understand memory and instruction execution process
4. To interface different peripherals to Microcontrollers.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Describe the Architecture of 8085 microprocessors and microcontroller
2. Write simple assembly language programs
3. Implement simple interfacing experiments on Arduino
4. Programs Arduino platforms
5. Understand ADC and interfacing mechanism
6. Develop simple applications using microcontrollers

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | Microprocessor: Architecture of 8085, Addressing modes, memory interfacing, Instruction set of 8085, Interrupts in 8085. | 08 |
| 2 | Microcontroller: Introduction to 8051 microcontroller, block diagram of microcontroller, comparison of microprocessor and microcontroller, Arduino Uno: A Microcontroller-Introduction, software, hardware, features of Microcontroller, Different types of microcontrollers, concept of interfacing | 06 |
| 3 | Microcontroller based development boards: study of Raspberry Pi, Arduino platforms | 06 |
| 4 | Programming Microcontrollers: Learning Arduino code basics: Arduino C-Arduino Program Structure, variables, Using Mathematical Operators, using Arduino String Functionality, Repeating a Sequence of Statements, | 06 |
| 5 | Interfacing: Interfacing digital inputs and outputs, Flashing LED Lights with Raspberry Pi and Arduino , Connecting and Using LED, interfacing 7-segment display, Interfacing keypad , Measuring Distance using IR sensor, Detecting Light using LDR | 06 |
| 6 | Interrupt ,Timer and Communication: Arduino interrupts – interrupt example , Internal Timer of Arduino, Detecting Light , ADC interfacing - | 06 |

| | | |
|---|---|---|
| | Measuring Temperature, Arduino – Communication, Serial Communications-Introduction, Types of Serial Communications, Sending and Receiving Serial Data from/to Arduino. | |

**For practical minimum 12 experiments on above syllabus should be completed**

**TEXT BOOKS :**

1. The INTEL Microprocessors ; Architecture, Programming and Interfacing By Barry B Brey ( 8th Edition)
2. Microprocessors and Microcontrollers- N. Senthi Kumar, M, Saravanam And S Jeevananthan (Oxford University Press)
3. Raspberry Pi Home Automation with Arduino, Dennis Andrew K, Packt Publishing Limited.
4.Programming Arduino: Getting Started with Sketches, Second Edition, Simon Monk

REFERENCE BOOKS:

1. Microprocessor Architecture ,Programming and Application with 8085 By Ramesg Gaonkar

# PCC-CS306 – C Programming

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory:** 3 Hrs. / Week | **Term work:** 50 marks |
| | **Tutorial:** | **Theory :** -- |
| | **Practical:** 4 Hrs. / Week | **Practical :** 50 marks |

**Prerequisite:** Basic knowledge of Electronics and Computers

**Course Objectives:**

1. To learn programming language C
2. To learn problem solving techniques.
3. To analyze problems and write programs using C language

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Articulate the principles of procedure-oriented problem solving and programming.
2. Explain programming fundamentals including statements, control flow and recursion
3. Able to formulate problems and implement algorithms in C . .
4. Analyze and use data structures to solve the complex problem statements. .
5. Demonstrate file operations using file handling concepts through developing applications.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Introduction to C:**<br>The Form of a C Program, The Library and Linking, Separate Compilation, Compiling a C Program, C's Memory Map; Expressions – The Basic Data Types, Modifying the Basic Types, Identifies Names, Variables, The Four C Scopes, Type Qualifiers-const, volatile, Storage Class Specifiers; Statements - Selection Statements, Iteration Statements, Jump Statements, Expression Statements, Block Statements. | 07 |
| 2 | **Console I/O & Basics of Array and Strings.**<br>Console I/O: Reading and Writing Characters, Reading and Writing Strings, Formatted Console I/O, printf(), scanf(), Suppressing Input.Arrays and Strings- Two-Dimensional Arrays, Arrays of Strings, Multidimensional Arrays, Array Initialization, Variable-Length Arrays. | 07 |
| 3 | **Functions:**<br>The General Form of a Function, Understanding the Scope of a Function, Parameter passing, Passing arrays to functions, Function Arguments, argc and argv-Arguments to main(),The return Statement, What Does main( ) Return?, Recursion, Function Prototypes, Declaring Variable Length Parameter Lists, The inline Keyword. | 07 |
| 5 | **Structures, Unions, Enumerations, and typedef :**<br>Structures, Arrays of Structures, Passing Structures to Functions, Structure Pointers, Arrays and Structures Within Structures, Unions, Bit-Fields, Enumerations, Using sizeof to Ensure Portability, typedef . | 08 |

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|---|---|---|
| 6 | **File I/O :**<br>File I/O, Standard C vs. Unix File I/O, Streams and Files, File System Basics, fread( ) and fwrite(), fseek() and Random-Access I/O, fprintf( ) and fscanf(), The Standard Streams. | 07 |

**Instructions for Practical Examinations:**

It should consist of minimum 10-12 experiments based on the syllabus and concepts mention below. Students of different batches should implement different programs. Student should perform all Practical's GCC compiler under linux environment.

**List of Experiments**

1. Branching Statements
2. Looping
3. Arrays
4. Functions
5. Storage Class.
6. Structures.
7. Implementation of STACK.
8. Implementation of QUEUE.
9. Implementation of LINKED LIST.
10. Copy Contents of one file to another file.
11. Implementation of GRAPH.
12. Implementation of TREE.

**Breakup of term work marks:**

- MCQ Test to check the C Programming Skills -10 Marks.
- Mid-semester Practical test – 10 Marks.
- End-semester Practical test – 10 Marks.
- Practical performance – 20 Marks.

**TEXT BOOKS :**

1. C the Complete Reference by Herbert Schild (Tata McGraw Hill) 4th Edition.
2. The C Programming Language- Brian W. Kernighan, Dennis Ritchie 2nd Edition.

**REFERENCE BOOKS:**

1. Programming in ANSI C by E. Balaguruswamy.(Tata McGraw Hill)4th Edition.
2. Let Us C By Yashavant P. Kanetkar, 5th Edition.

# HM-DS307– SOFT SKILLS

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** | **Term work:** 25 Marks |
| | **Tutorial:** | **Theory :** -- |
| | **Practical:** 2 Hrs. / Week | **Practical :** 25 Marks |

**Prerequisite:**

**Course Objectives:**

1. To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
2. To develop and nurture the soft skills of the students through individual and group activities.
3. To expose students to right attitudinal and behavioral aspects and to build the same through activities
4. To encourage the all-round development of students by focusing on soft skills.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Effectively communicate through verbal/oral communication and improve the listening skills
2. Actively participate in group discussion / meetings / interviews and prepare & deliver presentations.
3. Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

| | |
|---|---|
| 1 | Understanding Communication Skills: Verbal Communication - Effective Communication - Active listening – Articulation Paraphrasing – Feedback<br>➢ Non- Verbal Communication - Body Language of self and others |
| 2 | Behavioral Skills /Self Development: SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self esteem. |
| 3 | Leadership and Team Building<br>➢ Culture and Leadership- Salient Features of Corporate Culture, Leadership Styles, Leadership Trends<br>➢ Team Building- Team Development Stages, Types of Teams, Attributes of a successful team – Barriers involved |
| 4 | Developing Writing skills<br>➢ E-mail writing, report writing, resumes writing, practice. |
| 5 | Stress and Time Management<br>➢ Stress in Today‘s Time- Identify the Stress Source, Signs of Stress, Ways to Cope with Stress.<br>➢ Healthier Ways to Combat Stress, Steps to be taken in the Organizations: Open communication, Time Management, Working towards Your Goals, Smart Work, Prioritize your Tasks |
| 6 | Professional Skill<br>➢ Ethics, Etiquette and Mannerism-All types of Etiquette (at Meetings, Etiquette at Dining. Involuntary Awkward Actions, Public Relations Office(PRO)‘s Etiquettes) |

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|---|---|
| | ➢ Technology Etiquette: Phone Etiquette, Email Etiquette, Social Media Etiquette, Video Conferencing Etiquette, Interview Etiquette.<br>➢ Dressing Etiquettes: for Interview, offices and social functions.<br>➢ Ethical Values: Importance of Work Ethics, Problems in the Absence of Work Ethics. |

**TERM WORK:**

1. The instructor shows videos to enhance skills supporting career aspects and discussion about same videos. Multiple set of observations based on videos can be prepared by students.
2. Multiple set of activity based assignments can be prepared to allow multiple skills exposure for example a group task encouraging discussions, team building, value sharing, leadership and role play all at the same time. Every student must be given adequate opportunity to participate actively in each activity.
3. Each student will write one report based on visit / project / business proposal etc.
4. Faculty may arrange one or more sessions from following: Yoga and Meditation. Stress management, relaxation exercises, and fitness exercises. Time management and personal planning sessions.
5. The student must prepare the journal in the form of report elaborating the activities performed in the lab. Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities-SWOT analysis, presentations, team activity, event management, group discussion, Group exercises and interpersonal skills and similar other activities/assignments.

**TEXT BOOKS :**

1. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
2. Gajendra Singh Chauhan, Sangeeta Sharma: Soft Skills – An Integrated Approach to Maximize Personality, WILEY INDIA, ISBN:13:9788126556397
3. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.

**REFERENCE BOOKS:**

1. Indrajit Bhattacharya, ―An Approach to Communication Skills‖, Delhi, Dhanpat Rai, 2008.
2. Seven Spiritual Laws of Success - Deepak Chopra
3. Simon Sweeney, ―English for Business Communication‖, Cambridge University Press, ISBN 13:978-0521754507.

# S. Y. B.Tech (Computer Science and Engineering) Sem – IV

## PCC-DS-401– Automata Theory

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** 3 Hrs/Week | **Term work:** 25 marks |
| | **Tutorial :** 1 Hrs/Week | **Theory :** 100 marks |
| | **Practical: --** | **Practical : --** |

**Prerequisite:** Basic Mathematical Concepts, Sets, graphs.

**Course Objectives:**

1. To introduce students to the mathematical foundations of computation, the theory of formal languages and grammars
2. To strengthen the students' ability to understand and conduct mathematical proofs for computations
3. To make the students understand the use of automata theory in Compliers & System Programming.
4. To analyze and design finite automata, pushdown automata, grammars & turing machines

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Understand basic concepts of Regular Language and Regular Expressions
2. Select appropriate abstract machine to recognize a given formal language.
3. Generate complex languages by applying Union, Intersection, Complement, Concatenation and Kleene * operations on simple languages.
4. Apply parsing concepts for syntax analysis.
5. Be familiar with thinking analytically and intuitively for problem solving situations in related areas of theory in computer science.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Regular Languages and Finite Automata**<br>Proofs, Recursive Definitions, Regular expressions and regular languages, Finite Automata, unions, intersection & complements of regular languages, Applications of FA | 07 |
| 2 | **Nondeterminism and Kleene's Theorem**<br>Nondeterministic finite automata, NFA with null transition, Equivalence of FA's, Kleene's Theorem (Part I & Part II), Minimal Finite Automata | 06 |
| 3 | **Context free Grammars**<br>Definition, Union, Concatenation and Kleene *'s of CFLs, Derivation trees and ambiguity, Simplified forms and normal forms | 05 |
| 4 | **Parsing and Pushdown Automata**<br>Definition of Pushdown Automata, Deterministic PDA, Equivalence of CFG's & PDA's, Top down parsing, bottom up parsing. | 06 |
| 5 | **Context free languages**<br>CFL's and non CFL's**,** Pumping Lemma, intersections and complements of CFLs | 07 |
| | **Turing Machines** | |

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|---|---|---|
| 6 | Definition, TM as language acceptors, combining Turing Machines**,** Computing partial function with a TM, Multi-tape TMs, and Universal TM | 07 |

**Term work:**

- It should consist of minimum 10-12 assignments based on topics of syllabus, exercise problems from the textbooks.
- 3-4 assignments should be implemented using programming language.

**Text Books:**


1. Introduction to Languages & the Theory of Computations - John C. Martin (Tata MGH Edition)
2. Discrete Mathematical Structures with applications to Computer Science - J .P. Trembley & R. Manohar (MGH)


**Reference Books:**


1. Introduction to Automata Theory, Languages and computation - John E. Hopcraft, Raje
2. Motwani, Jeffrey D. Ullman (Pearson Edition)
3. Introduction to theory of Computations - Michael Sipser (Thomson Books/Cole)
4. Theory of Computation - Vivek Kulkarni
5. Theory of Computation A problem Solvin

# PCC-CS-402– Computer Networks Protocols

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** 3 Hrs/Week | **Term work:** 25 marks |
| | **Tutorial : __** | **Theory :** 100 marks |
| | **Practical:** 2 Hrs/Week | **Practical :** 50 Marks |

**Prerequisite:** Computer Network-I.

**Course Objectives:**

1. To understand the Client server model & socket interface
2. To perceive IPv6 addressing and protocol
3. To explain and learn basic internet technology protocols
4. Simulate protocols using software tools.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Program the client server model using sockets
2. Apply next generation protocol and addressing model
3. Elaborate the fundamentals of Domain Name Systems
4. Apply the concepts of Remote login and FTP in network applications
5. Learn fundamentals of web, HTTP and e-mail communication protocols.
6. Understand multimedia streaming and relevant protocols.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Client server model & socket interface:** The Socket Interface, The Client Server model and Software design, Concurrent processing in client-server software, Algorithms and issues in Client-Server design, Multiprotocol Servers, Multiservice Servers, Concurrency in clients, Unix Internet Super server (inetd). | 07 |
| 2 | **Next Generation IPv6 and ICMPv6:** IPV6 addresses, packet format, ICMPV6, Transaction from IPV4 to IPV6 | 06 |
| 3 | **BOOTP, DHCP and Domain name system:** Name Space, Domain Name Space, Distribution of name space, and DNS in internet, Resolution, DNS massages, Types of records, Compression examples, and encapsulation. BOOTP, DHCP | 06 |
| 4 | **Remote Login: TELNET and File Transfer FTP, TFTP:** Concept, NVT, Embedding, Options & options/sub-option negotiation, controlling the server, Out-of-band signaling, Escape charter, Mode of operation, user interface. **FTP:** Connections, Communication, Command processing, File transfer, User interface, Anonymous FTP, TFTP. | 07 |
| 5 | **Web Applications Service Protocols:** HTTP: Architecture, Web Documents, HTTP Transaction, Request and Response, HTTP Headers and Examples, Persistent Vs Non- Persistent HTTP, Proxy servers. | 07 |

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|---|---|---|
| | **Electronic Mail:** Architecture, User agent, addresses, Delayed delivery, SMTP commands and responses, Mail transfer phases, MIME, POP3 | |
| 6 | **Multimedia In Internet:** Streaming stored audio/video, Streaming live audio/video, Real time interactive audio/video, Real Time Transport Protocol (RTP), Real Time Transport Control Protocol (RTCP), Voice Over IP (VoIP), Session Initiation Protocol (SIP) | 06 |

**Term work:**

It should consist of minimum 8 - 10 experiments based on the following guidelines

a. Client program using UDP to connect to well known services (echo, time of the day service etc.).
b. Implementing concurrent TCP multiservice client/server.
c. Implementing Iterative UDP client/server.
d. Study of following DNS Tools with all its options. nslookup, dig, host, whois.
e. Implement trivial file transfer protocol (TFTP).
f. Configuration of basic services for FTP,HTTP,Telnet etc. on Linux Platform
g. Write program to send a mail using SMTP commands and receive a mail using POP3 commands.
h. Capturing & Analyzing operation of various application layer protocols using network protocol analyzer. (Wireshark and tcpdump)
i. Study of various streaming multimedia protocols in Internet (Using various audio/video streaming services on the Internet)

**Text Books:**

1. TCP/IP Protocol Suite by Behrouz A. Forouzan McGraw-Hill Publication, 4th Edition.
2. Computer Networks by Andrew S Tanenbaum.

**Reference Books:**

1. Data Communications and Networking by Behrouz A Forouzan
2. Internetworking with TCP/IP by Douglas Comer
3. Computer Networking: A Top-Down Approach by Jim Kurose

# BSC-DS403– Statistic for Data Science

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** 3 Hrs/Week | **Term work:** -- |
| | **Tutorial :** -- | **Theory :** 100 marks |
| | **Practical:** -- | **Practical :** -- |

**Prerequisite:** Mathematics

**Course Objectives:**

1. The Number Theory basic concepts useful for cryptography etc
2. The theory of Probability, and probability distributions of single and multiple random variables
3. The sampling theory and testing of hypothesis and making inferences
4. Stochastic process and Markov chains.

**Course Outcomes:**
Upon successful completion of this course, the student will be able to –

1. Apply the number theory concepts to cryptography domain
2. Apply the concepts of probability and distributions to some case studies
3. Correlate the material of one unit to the material in other units
4. Resolve the potential misconceptions and hazards in each topic of study.

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1. | **Greatest Common Divisors and Prime Factorization:** Greatest common divisors, The Euclidean algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers<br>**Congruences:** Introduction to congruences, Linear congruences, The Chinese remainder theorem, Systems of linear congruences | 06 |
| 2. | **Simple Linear Regression and Correlation:** Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Simple Linear Regression Case Study | 06 |
| 3. | **Random Variables and Probability Distributions:** Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence.<br>Discrete Probability Distributions: Binomial Distribution, Poisson distribution. | 06 |
| 4. | **Continuous Probability Distributions:** Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial | 06 |

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|---|---|---|
| | **Fundamental Sampling Distributions:** Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t–Distribution, FDistribution. | |
| 5. | **Estimation & Tests of Hypotheses:** Introduction, Statistical Inference, Classical Methods of Estimation. Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Estimating the Variance, Estimating a Proportion for single mean , Difference between Two Means, between Two Proportions for Two Samples and Maximum Likelihood Estimation. | 06 |
| 6. | **Stochastic Processes and Markov Chains:** Introduction to Stochastic processes- Markov process.<br>Transition Probability, Transition Probability Matrix, First order and Higher order Markov process,<br>nstep transition probabilities, Markov chain, Steady state condition, Markov analysis. | 06 |

**TEXT BOOKS:**


1. Kenneth H. Rosen, Elementary number theory & its applications, sixth edition, AddisonWesley, ISBN 978 0-321-50031-1
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
3. S. D. Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi


**REFERENCE BOOK:**


1. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications
2. T.T. Soong, Fundamentals of Probability And Statistics For Engineers, John Wiley & Sons Ltd, 2004.
3. Sheldon M Ross, Probability and statistics for Engineers and scientists, Academic Press.

# PCC-CS-404– Operating System

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** 3 Hrs/Week | **Term work:** 25 marks |
| | **Tutorial :** 1 Hrs/Week | **Theory :** 100 marks |
| | **Practical: --** | **Practical :** -- |

**Prerequisite:** Microprocessor and Microcontrollers

**Course Objectives:**

1. To make the students understand basic concepts of operating system
2. To expose the students to various functions of the Operating system and their usage
3. To give hands on exposure to Linux commands and system calls.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Understand operating systems functions
2. Write simple systems calls using fork()
3. Understand synchronization and critical section problems
4. Remember Concept of dead locks
5. Understand memory management concepts

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Overview of OS**<br>Abstract view of an operating system, Fundamental principles of OS operations, OS interaction with the computer and user programs, Efficiency ,system performance and user service, Batch Processing System, Multiprogramming System, The Time Sharing System, The Real Time Operating System, Distributed operating system, Operation of OS, Operating system with monolithic structure, Virtual machine operating system, Kernel based operating system, Microkernel based operating system | 6 |
| 2 | **Processes, Threads and Synchronization**<br>Processes and programs, Implementing processes, Threads, Process synchronization, Race condition, Critical Section, Synchronization approaches, Classic process synchronization problems, Semaphores, Monitors | 6 |
| 3 | **Process Scheduling:** Scheduling terminology and concepts, Non preemptive scheduling policies, Preemptive scheduling policies, Long, Medium and short term scheduling | 6 |
| 4 | **Deadlock :** What is deadlock, Deadlock in resource allocation, Handling Deadlocks : Deadlock Detection and Resolution, Deadlock prevention, Deadlock avoidance | 6 |
| 5 | **Memory Management :** Managing the memory hierarchy, Static and Dynamic Memory Allocation, Heap Management, Contiguous Memory Allocation and Non Contiguous Allocation, Segmentation and Segmentation with paging, Virtual memory basics, Demand paging, Page replacement policies | 8 |

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|---|---|---|
| 6 | **File systems and I/O systems:** Overview of file processing, Files and file operations, Fundamental file organizations and access methods, Layers of the Input Output control system, Overview of I/O system. | 6 |

**Term work:**

The tutorials should be conducted on the following guidelines.

1. Six assignments should be based on theoretical / analytical concepts, preferably from the exercises of the books covering all topics of the syllabus.
2. Four assignments should on usage of Unix / Linux commands and system calls concerned with General purpose utilities, file system, handling ordinary files, basic file attributes, the Shell, the Process and Filters using regular expressions as mentioned in the reference book at serial no. 1.
3. Installation of any two operating system using VMware.

These assignments should be practically conducted during the tutorial sessions.

**Text Books:**


1. Operating Systems -A Concept Based approach -Dhananjay M Dhamdhere (TMGH).3rd edition.
2. Operating System Concepts -Abraham Silberschatz, Peter B. Galvin & Grege Gagne (Wiley)


**Reference Books:**


1. Unix Concepts and Applications –Sumitabha Das (TMGH).
2. Operating System: Concepts and Design -Milan Milenkovic ( TMGH)
3. Operating System with case studies in Unix, Netware and Windows NT -Achyut S. Godbole (TMGH).

# PCC-DS-405– Software Engineering

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory :** 3 Hrs/Week | **Term work:** -- |
| | **Tutorial :** -- | **Theory :** 100 marks |
| | **Practical:** -- | **Practical :** -- |

**Prerequisite:** Programming in C

**Course Objectives:**

1. To expose the students to basic concepts & principles of software engineering.
2. To make the student aware of the importance of SDLC in their project development work.
3. To expose the students to software testing techniques and software quality management.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Comprehend systematic methodologies of SDLC (Software Development Life Cycle)
2. Discriminate competing and feasible system requirements indicating correct real world problem scope and prepare stepwise system conceptual model using stakeholder analysis and requirement validation.
3. Prepare SRS document for a project
4. Apply software design and development techniques
5. Develop a quality software project through effective team-building, planning, scheduling and risk
6. Understand testing methods at each phase of SDLC

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **The software Problem:** Cost, Schedule & Quality, Scale and Change, Software Processes: Process & Project, Component Software Processes, Software Development process Models, Project Management Process. | 06 |
| 2 | **Software Requirements Analysis & specification:** Value of Good SRS, Requirement Process, Requirements Specification, Other Approaches for Analysis, Validation | 05 |
| 3 | **Software Planning & Scheduling:** Responsibilities of Software Project Man agent, Project Planning, Project Scheduling, Project Staffing, People CMM, Risk Management | 06 |
| 4 | **Design:** Design Concepts, Function Oriented Design, Object Oriented Design, Detail Design, Verification, Metrics | 06 |
| 5 | **Coding & Testing** Coding & Code Review, Testing, Unit Testing, Black Box Testing, White Box Testing, Program Analysis Tools, Integration Testing, System Testing | 07 |

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| 6 | **Software Reliability & Quality Management**<br>Reliability, Software Quality, Software Quality Management System, ISO 9000, SEI capability Maturity Model, Six Sigma, Agile Software Development & Extreme Programming, Agile Project Management | 06 |

**Text Books:**


1. Software Engineering: A precise Approach - Pankaj Jalote (Wiley India) (Unit 1,2,4).
2. Fundamentals of Software Engineering – Rajib Mall (3rd Edition) (PHI) (Unit 5, 6).
3. Software Engineering by Jan Sommerville (9th Edition) Pearson (Unit 6, 7 & 6.8).
4. Software Engineering Principles & Practices by Rohit Khurana ITLESL (2nd Edition) Vikas Publishing House Pvt. Ltd. (Unit 3).


**Reference Books:**


1. Software Engineering - Concepts & Practices -- Ugrasen Suman (Cenage Learning)
2. Software Engineering Fundamentals -- Behforooz & Hudson (Oxford: Indian Edition 1st)

# PCC-DS-406– Python for Data Science

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory:** 2 Hrs./Week | **Term work:** 50 marks |
| | **Tutorial:** -- | **Theory :** -- |
| | **Practical:** 4 Hrs./Week | **Practical :** 50 marks |

**Prerequisite:** Mathematics, Statistics

**Course Objectives:**

1. To understand Python programming language
2. To program simple algorithms for Data Science applications
3. To Understand different libraries used in Data Science
4. To apply Python to solve some problems in Data Science.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Identify the need for data science and solve basic problems using Python built-in data types and their methods.
2. Design an application with user-defined modules and packages using OOP concept
3. Employ efficient storage and data operations using NumPy arrays.
4. Apply powerful data manipulations using Pandas.
5. Do data preprocessing and visualization using Pandas

| Unit No. | Unit Name and Contents | No. of Lectures |
|---|---|---|
| 1 | **Introduction to Python -** Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types. Operators. | 06 |
| 2 | **User defined Modules and Packages in Python-** Files: File manipulations, File and Directory related methods - Python Exception Handling. OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance. | 06 |
| 3 | **NumPy Basics:** Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-SortingUnique and Other Set Logic. | 06 |
| 4 | **Introduction to pandas Data Structures:** Series, DataFrame, Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format. | 06 |
| 5 | **SciPy Library for statistics**, Basic statistics, prametric and non-parametric techniques for comparing Means. Data Cleaning and Preparation: Handling Missing | 07 |

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| | Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values | |
| 6 | **Detecting and Filtering Outliers**- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots. | 06 |

**Text Books:**


1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012
2. Data Analytics using Python ,Bharti Motwani,Wiley Publications
3. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.
4. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017


**Reference Books:**


1. Wesley J. Chun, "Core Python Programming", Prentice Hall,2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

# PW-DS407– Mini Project

| | TEACHING SCHEME | EXAMINATION SCHEME |
|---|---|---|
| | **Theory : --** | **Term work:** 25 marks |
| | **Tutorial :** -- | **Theory : --** |
| | **Practical:** 2 Hrs./Week | **Practical :** 50 marks |

**Pre-requisites:** Knowledge of software engineering and C/C++

**Course Objectives:**

1. To expose the students to solve the real world problems.
2. To utilize the techniques. Skills and modern Engineering tools for building the project.
3. To follow the methods and tasks as per SDOLC Approach

**Course Outcomes:**

Upon successful completion of this course, the student will be able to –

1. Define the problem statement.
2. Organize, Plan and prepare the detailed project activities.
3. Construct Flowchart, System Architecture based on the project description
4. Implement the solution for their problem.

**Platform: - C**, C++

**Course Contents/Description: -**

The Mini Project should be undertaken preferably by a group of 3-4 students who will jointly work together and implement the project. The Mini Project topic should be based on the any one subject concept that students have studied for their Academic Year. The group will select the project with the approval of the guide and submit the name of the project with a synopsis of the proposed work not more than 02 to 03 pages. In the Synopsis they have to state Flowchart, Usage of the logic, algorithm, functions and suitable data structure for implementing the solution. They have to implement project using C, C++ languages.